



# Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 05:07 AM EDT

PDB ID : 2BWP / pdb\_00002bwp  
Title : 5-Aminolevulinate Synthase from Rhodobacter capsulatus in complex with glycine  
Authors : Astner, I.; Schulze, J.O.; Van Den Heuvel, J.J.; Jahn, D.; Schubert, W.-D.; Heinz, D.W.  
Deposited on : 2005-07-15  
Resolution : 2.70 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : 2.0  
EDS : 3.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

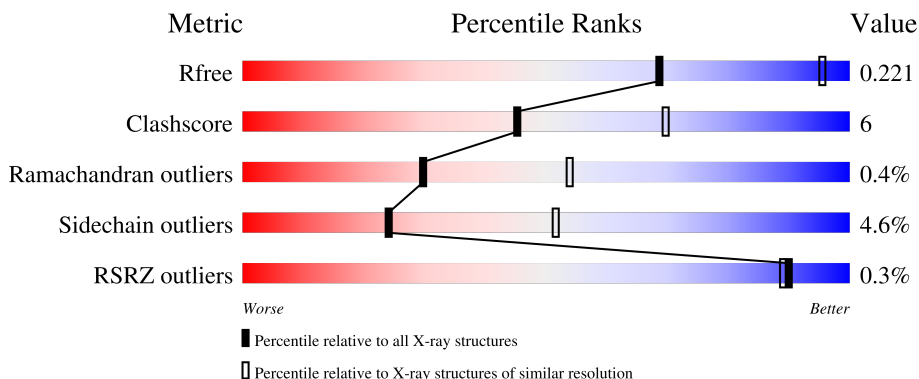
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*


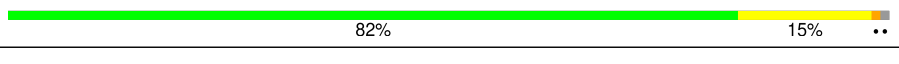
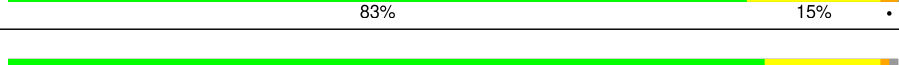

The reported resolution of this entry is 2.70 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	401	 83% 14% ..
1	B	401	 82% 15% ..
1	D	401	 83% 15% ..
1	E	401	 85% 13% ..

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 12383 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called 5-AMINOLEVULINATE SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	398	3048	1936	539	558	15	0	0	0
1	B	396	3029	1922	536	556	15	0	0	0
1	D	398	3048	1936	539	558	15	0	0	0
1	E	398	3048	1936	539	558	15	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

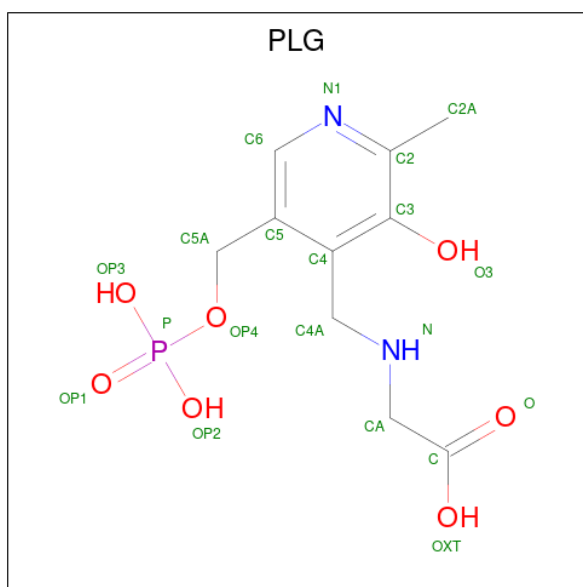
Chain	Residue	Modelled	Actual	Comment	Reference
A	102	GLY	ASP	variant	UNP P18079
A	105	GLN	GLY	variant	UNP P18079
A	117	ASN	ILE	variant	UNP P18079
A	128	VAL	LEU	variant	UNP P18079
A	205	GLU	ASP	variant	UNP P18079
A	262	ARG	LYS	variant	UNP P18079
B	102	GLY	ASP	variant	UNP P18079
B	105	GLN	GLY	variant	UNP P18079
B	117	ASN	ILE	variant	UNP P18079
B	128	VAL	LEU	variant	UNP P18079
B	205	GLU	ASP	variant	UNP P18079
B	262	ARG	LYS	variant	UNP P18079
D	102	GLY	ASP	variant	UNP P18079
D	105	GLN	GLY	variant	UNP P18079
D	117	ASN	ILE	variant	UNP P18079
D	128	VAL	LEU	variant	UNP P18079
D	205	GLU	ASP	variant	UNP P18079
D	262	ARG	LYS	variant	UNP P18079
E	102	GLY	ASP	variant	UNP P18079
E	105	GLN	GLY	variant	UNP P18079
E	117	ASN	ILE	variant	UNP P18079

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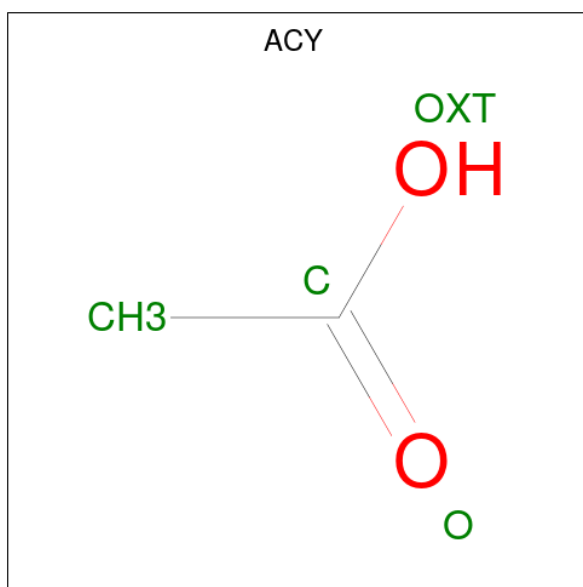
Chain	Residue	Modelled	Actual	Comment	Reference
E	128	VAL	LEU	variant	UNP P18079
E	205	GLU	ASP	variant	UNP P18079
E	262	ARG	LYS	variant	UNP P18079

- Molecule 2 is N-GLYCINE-[3-HYDROXY-2-METHYL-5-PHOSPHONOXYMETHYL-PYRIDIN-4-YL-METHANE] (CCD ID: PLG) (formula: C<sub>10</sub>H<sub>15</sub>N<sub>2</sub>O<sub>7</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total	C	N	O	P	0	0
			20	10	2	7	1		
2	B	1	Total	C	N	O	P	0	0
			20	10	2	7	1		
2	D	1	Total	C	N	O	P	0	0
			20	10	2	7	1		
2	E	1	Total	C	N	O	P	0	0
			20	10	2	7	1		

- Molecule 3 is ACETIC ACID (CCD ID: ACY) (formula: C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0
3	E	1	Total C O 4 2 2	0	0

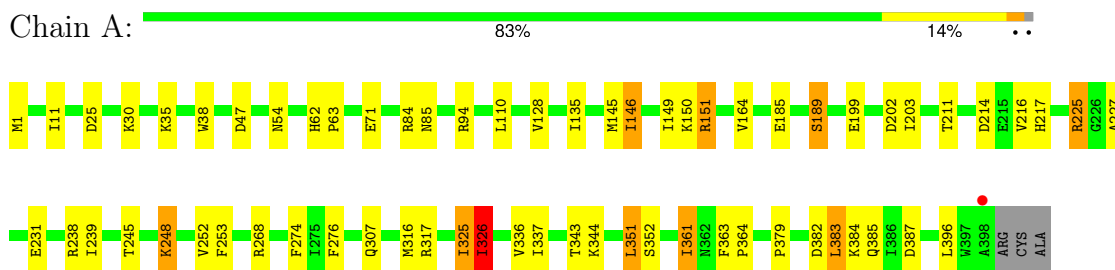
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	27	Total O 27 27	0	0
4	B	29	Total O 29 29	0	0
4	D	32	Total O 32 32	0	0
4	E	30	Total O 30 30	0	0

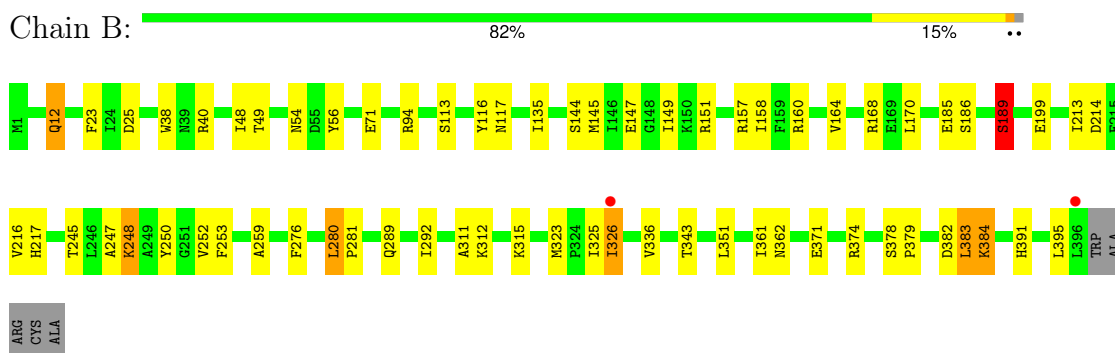
### 3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

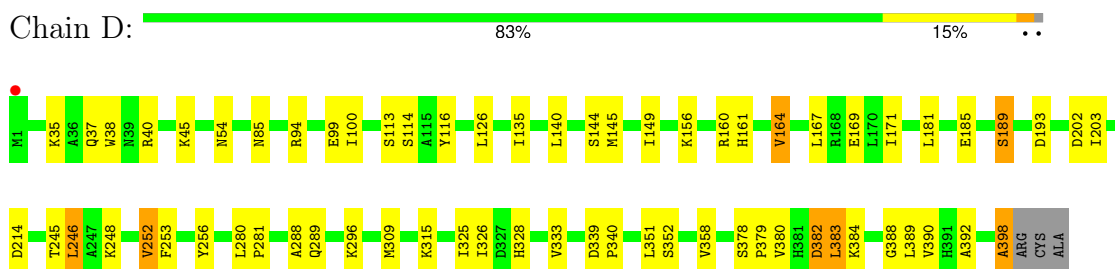
- Molecule 1: 5-AMINOLEVULINATE SYNTHASE



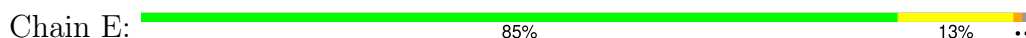
- Molecule 1: 5-AMINOLEVULINATE SYNTHASE

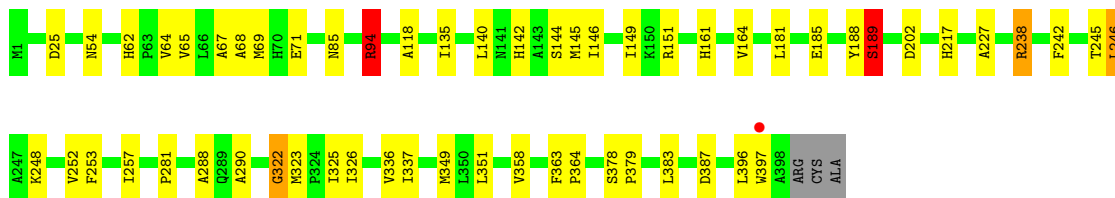


- Molecule 1: 5-AMINOLEVULINATE SYNTHASE



- Molecule 1: 5-AMINOLEVULINATE SYNTHASE





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.00Å 92.02Å 248.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.70 50.00 – 2.70	Depositor EDS
% Data completeness (in resolution range)	96.5 (50.00-2.70) 96.4 (50.00-2.70)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.48 (at 2.68Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.166 , 0.220 0.169 , 0.221	Depositor DCC
$R_{free}$ test set	2061 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	50.4	Xtrriage
Anisotropy	0.192	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 47.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	12383	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	30.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.12% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: ACY, PLG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	1.07	4/3118 (0.1%)	1.00	4/4225 (0.1%)
1	B	1.05	6/3097 (0.2%)	1.02	3/4195 (0.1%)
1	D	1.18	4/3118 (0.1%)	1.07	5/4225 (0.1%)
1	E	1.12	9/3118 (0.3%)	1.02	4/4225 (0.1%)
All	All	1.11	23/12451 (0.2%)	1.03	16/16870 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	E	0	1

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	398	ALA	C-O	20.01	1.63	1.23
1	E	323	MET	CA-C	8.41	1.60	1.52
1	E	290	ALA	CA-CB	-7.90	1.41	1.53
1	B	12	GLN	CD-NE2	7.22	1.48	1.33
1	E	337	ILE	CA-CB	7.21	1.63	1.54
1	D	388	GLY	C-O	7.19	1.32	1.23
1	B	248	LYS	CA-C	7.08	1.56	1.52
1	B	336	VAL	CA-CB	6.86	1.62	1.54
1	A	361	ILE	CA-CB	6.51	1.61	1.54
1	E	358	VAL	CA-CB	6.21	1.62	1.54
1	A	248	LYS	CA-C	6.16	1.55	1.52
1	D	358	VAL	CA-CB	6.00	1.62	1.54
1	B	49	THR	CA-CB	5.89	1.61	1.53
1	A	325	ILE	CA-CB	5.86	1.61	1.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	12	GLN	CD-OE1	5.74	1.34	1.23
1	E	146	ILE	CA-CB	5.58	1.60	1.54
1	E	336	VAL	CA-CB	5.56	1.60	1.54
1	E	118	ALA	CA-CB	-5.21	1.45	1.53
1	D	252	VAL	CA-CB	5.16	1.61	1.54
1	E	68	ALA	CA-CB	5.15	1.61	1.53
1	E	227	ALA	CA-CB	-5.05	1.44	1.53
1	B	259	ALA	C-O	-5.04	1.20	1.24
1	A	128	VAL	CA-CB	5.02	1.60	1.54

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	323	MET	N-CA-C	-7.73	95.96	109.48
1	B	326	ILE	N-CA-CB	6.56	117.87	110.72
1	A	189	SER	N-CA-C	6.41	119.08	111.71
1	E	94	ARG	CB-CA-C	-6.12	101.20	110.92
1	E	189	SER	N-CA-C	6.10	119.56	111.75
1	A	326	ILE	CB-CA-C	-5.98	103.72	110.96
1	D	189	SER	N-CA-C	5.79	119.17	111.75
1	D	389	LEU	O-C-N	5.64	128.18	122.09
1	A	352	SER	N-CA-C	5.51	118.21	111.82
1	A	276	PHE	N-CA-C	5.41	118.70	112.97
1	D	390	VAL	N-CA-C	5.36	117.75	111.05
1	B	189	SER	N-CA-C	5.33	118.57	111.75
1	D	392	ALA	N-CA-C	5.29	117.80	111.71
1	D	352	SER	N-CA-C	5.16	117.81	111.82
1	B	276	PHE	N-CA-C	5.13	118.41	112.97
1	E	322	GLY	N-CA-C	5.05	123.71	115.67

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	E	322	GLY	Peptide

## 5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within

the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3048	0	3030	41	0
1	B	3029	0	3015	35	0
1	D	3048	0	3030	40	0
1	E	3048	0	3030	38	0
2	A	20	0	12	3	0
2	B	20	0	12	1	0
2	D	20	0	11	6	0
2	E	20	0	12	4	0
3	A	4	0	3	0	0
3	D	4	0	3	1	0
3	E	4	0	3	0	0
4	A	27	0	0	1	0
4	B	29	0	0	0	0
4	D	32	0	0	1	0
4	E	30	0	0	1	0
All	All	12383	0	12161	143	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

All (143) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:398:ALA:C	1:D:398:ALA:O	1.63	1.39
1:D:383:LEU:H	1:D:383:LEU:HD23	1.22	1.02
1:D:383:LEU:H	1:D:383:LEU:CD2	1.74	1.00
1:A:248:LYS:NZ	2:A:500:PLG:H4A2	1.82	0.94
1:E:62:HIS:ND1	1:E:64:VAL:HG22	1.96	0.81
1:D:245:THR:HG21	1:D:248:LYS:HD3	1.63	0.80
1:E:67:ALA:O	1:E:71:GLU:HG2	1.84	0.78
1:A:248:LYS:HZ1	2:A:500:PLG:H4A2	1.47	0.77
1:E:238:ARG:HH11	1:E:238:ARG:HG2	1.49	0.77
1:B:113:SER:HB2	1:B:117:ASN:HD22	1.50	0.76
1:A:248:LYS:HZ3	2:A:500:PLG:H4A2	1.54	0.72
1:E:62:HIS:CE1	1:E:64:VAL:HG22	2.25	0.72
1:E:245:THR:HG21	1:E:248:LYS:HD2	1.73	0.71
1:D:382:ASP:OD1	1:D:384:LYS:HB2	1.93	0.69
1:E:142:HIS:CE1	2:E:500:PLG:H	2.11	0.68
1:D:383:LEU:CD2	1:D:383:LEU:N	2.54	0.67
1:E:94:ARG:HG2	1:E:94:ARG:HH11	1.60	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:113:SER:HB2	1:B:117:ASN:ND2	2.12	0.64
1:A:225:ARG:HG3	1:A:231:GLU:OE2	1.98	0.64
1:D:248:LYS:HZ1	2:D:500:PLG:HA2	1.64	0.63
1:E:142:HIS:HE1	2:E:500:PLG:H	1.47	0.63
1:E:202:ASP:OD1	1:E:238:ARG:NH2	2.32	0.62
1:E:248:LYS:NZ	2:E:500:PLG:H4A2	2.16	0.60
1:D:54:ASN:HB3	1:D:248:LYS:HG3	1.84	0.59
1:D:383:LEU:HD23	1:D:383:LEU:N	2.06	0.59
1:D:85:ASN:HB2	4:E:2001:HOH:O	2.02	0.58
1:A:145:MET:HE1	1:A:185:GLU:CG	2.33	0.58
1:A:151:ARG:NH2	1:B:147:GLU:O	2.37	0.57
1:B:145:MET:HE1	1:B:185:GLU:CG	2.34	0.57
1:B:378:SER:HB2	1:B:379:PRO:HD2	1.85	0.57
1:D:248:LYS:NZ	2:D:500:PLG:HA2	2.19	0.57
1:B:135:ILE:HG21	1:B:149:ILE:HG12	1.88	0.56
1:B:382:ASP:OD1	1:B:384:LYS:HB3	2.05	0.56
1:A:238:ARG:HH11	1:A:238:ARG:HG2	1.71	0.56
1:B:160:ARG:NH1	1:D:160:ARG:HD3	2.21	0.56
1:D:37:GLN:NE2	1:D:45:LYS:HD2	2.21	0.55
1:E:94:ARG:HG2	1:E:94:ARG:NH1	2.17	0.55
1:D:135:ILE:HG21	1:D:149:ILE:HG12	1.88	0.55
1:D:315:LYS:HG2	1:D:325:ILE:HD11	1.90	0.54
1:B:38:TRP:HB2	1:B:48:ILE:HD13	1.90	0.53
1:D:164:VAL:HG13	1:D:203:ILE:HD11	1.90	0.53
1:E:142:HIS:H	1:E:145:MET:HE3	1.74	0.53
1:A:110:LEU:HD11	1:A:274:PHE:CE2	2.43	0.52
1:D:339:ASP:OD1	1:D:340:PRO:HD2	2.10	0.52
1:E:145:MET:HE1	1:E:185:GLU:CG	2.39	0.52
1:E:135:ILE:HG21	1:E:149:ILE:HG12	1.90	0.52
1:B:54:ASN:HD21	1:B:374:ARG:HH12	1.56	0.52
1:E:142:HIS:CD2	1:E:144:SER:H	2.28	0.52
1:A:135:ILE:HG21	1:A:149:ILE:HG12	1.92	0.51
1:E:246:LEU:HG	1:E:288:ALA:HB1	1.91	0.51
1:D:145:MET:HE1	1:D:185:GLU:HG3	1.93	0.51
1:D:167:LEU:O	1:D:171:ILE:HG22	2.11	0.50
1:D:378:SER:HB2	1:D:379:PRO:HD2	1.91	0.50
1:E:65:VAL:O	1:E:69:MET:HG3	2.11	0.50
1:B:54:ASN:HB3	1:B:248:LYS:HG2	1.93	0.50
1:A:326:ILE:HD11	1:A:336:VAL:CG2	2.41	0.49
1:A:151:ARG:HG2	1:B:151:ARG:NH1	2.27	0.49
1:B:157:ARG:HB3	1:B:170:LEU:HD13	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:214:ASP:OD1	1:A:214:ASP:C	2.56	0.49
1:A:317:ARG:NH2	1:A:387:ASP:OD1	2.46	0.49
1:D:248:LYS:HE2	2:D:500:PLG:H4A2	1.95	0.49
1:E:238:ARG:HG2	1:E:238:ARG:NH1	2.16	0.49
1:B:189:SER:HB3	1:B:217:HIS:NE2	2.28	0.49
1:B:247:ALA:HB2	1:B:253:PHE:HA	1.95	0.48
1:D:193:ASP:HB3	1:D:328:HIS:CG	2.48	0.48
1:A:25:ASP:CG	1:B:94:ARG:HH11	2.21	0.48
1:E:378:SER:HB2	1:E:379:PRO:HD2	1.95	0.48
1:E:54:ASN:HB3	1:E:248:LYS:HG2	1.95	0.48
1:E:349:MET:HB3	1:E:396:LEU:HD11	1.96	0.48
1:A:164:VAL:HG11	1:A:199:GLU:HB3	1.96	0.47
1:B:391:HIS:CE1	1:B:395:LEU:HD11	2.49	0.47
1:B:214:ASP:C	1:B:214:ASP:OD1	2.57	0.47
1:D:140:LEU:HD12	1:D:161:HIS:CG	2.50	0.47
1:A:189:SER:HB3	1:A:217:HIS:CD2	2.50	0.47
1:B:362:ASN:HA	1:B:371:GLU:HG3	1.97	0.47
1:A:382:ASP:C	1:A:384:LYS:H	2.24	0.46
1:B:145:MET:HE1	1:B:185:GLU:HG2	1.97	0.46
1:B:186:SER:HB3	1:B:213:ILE:HD11	1.97	0.46
1:E:189:SER:HB3	1:E:217:HIS:NE2	2.30	0.45
1:E:140:LEU:HD12	1:E:161:HIS:CG	2.52	0.45
1:D:248:LYS:NZ	2:D:500:PLG:H4A2	2.32	0.45
3:D:600:ACY:O	1:E:85:ASN:HB3	2.16	0.45
1:E:181:LEU:C	1:E:181:LEU:HD23	2.42	0.45
1:D:99:GLU:OE2	1:D:296:LYS:NZ	2.39	0.45
1:D:246:LEU:HG	1:D:288:ALA:HB1	1.98	0.45
1:D:325:ILE:HD11	1:D:333:VAL:HG13	2.00	0.44
1:A:35:LYS:HE3	1:A:47:ASP:OD2	2.18	0.44
1:B:248:LYS:NZ	2:B:500:PLG:H4A2	2.31	0.44
1:D:214:ASP:OD1	1:D:214:ASP:C	2.59	0.44
1:E:142:HIS:N	1:E:145:MET:HE3	2.31	0.44
1:A:307:GLN:HB2	1:A:379:PRO:HD3	1.98	0.44
1:A:145:MET:HE1	1:A:185:GLU:HG2	2.00	0.44
1:B:145:MET:HE1	1:B:185:GLU:HG3	1.99	0.44
1:E:142:HIS:H	1:E:145:MET:CE	2.31	0.44
1:B:383:LEU:H	1:B:383:LEU:HD22	1.82	0.44
1:D:248:LYS:CE	2:D:500:PLG:H4A2	2.48	0.44
1:E:248:LYS:HZ3	2:E:500:PLG:H4A2	1.83	0.44
1:A:227:ALA:HB3	1:A:231:GLU:CD	2.43	0.43
1:D:114:SER:HB2	2:D:500:PLG:OP3	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:151:ARG:HD3	1:A:151:ARG:C	2.43	0.43
1:A:253:PHE:HB2	1:B:281:PRO:HG3	2.01	0.43
1:D:38:TRP:CZ2	1:D:40:ARG:HG2	2.53	0.43
1:E:54:ASN:ND2	1:E:248:LYS:HE3	2.34	0.43
1:B:164:VAL:HG11	1:B:199:GLU:HB3	2.01	0.43
1:E:363:PHE:CD1	1:E:364:PRO:HA	2.53	0.43
1:A:211:THR:OG1	1:A:239:ILE:HA	2.19	0.43
1:A:164:VAL:HG13	1:A:203:ILE:HD12	2.00	0.43
1:B:113:SER:HA	1:B:280:LEU:HD13	1.99	0.43
1:A:326:ILE:HD11	1:A:336:VAL:HG21	2.00	0.43
1:A:363:PHE:CG	1:A:364:PRO:HA	2.54	0.42
1:A:84:ARG:HA	1:A:84:ARG:HD2	1.90	0.42
1:A:216:VAL:HG13	1:A:245:THR:CG2	2.49	0.42
1:A:146:ILE:O	1:A:150:LYS:HG2	2.20	0.42
1:B:250:TYR:CE1	1:B:292:ILE:HA	2.54	0.42
1:D:202:ASP:HB3	4:D:2019:HOH:O	2.20	0.42
1:D:281:PRO:HG3	1:E:253:PHE:HB2	2.02	0.42
1:E:94:ARG:NH1	1:E:94:ARG:CG	2.82	0.42
1:A:337:ILE:HB	1:A:343:THR:OG1	2.20	0.42
1:B:56:TYR:O	1:B:378:SER:HB2	2.18	0.42
1:D:253:PHE:CD1	1:E:281:PRO:HD3	2.54	0.42
1:D:126:LEU:HD13	1:D:181:LEU:HD13	2.02	0.42
1:E:142:HIS:HD2	1:E:144:SER:OG	2.03	0.42
1:A:54:ASN:HD22	1:A:248:LYS:HE3	1.85	0.42
1:A:62:HIS:HA	1:A:63:PRO:HD3	1.95	0.41
1:B:216:VAL:HG13	1:B:245:THR:CG2	2.49	0.41
1:D:100:ILE:HG21	1:D:256:TYR:CD1	2.56	0.41
1:E:161:HIS:HE1	1:E:188:TYR:CD2	2.38	0.41
1:A:344:LYS:HE3	4:A:2006:HOH:O	2.19	0.41
1:E:363:PHE:CG	1:E:364:PRO:HA	2.56	0.41
1:A:25:ASP:OD2	1:B:94:ARG:NH1	2.48	0.41
1:A:94:ARG:NE	1:B:25:ASP:OD2	2.53	0.41
1:E:242:PHE:O	1:E:257:ILE:HA	2.21	0.41
1:B:311:ALA:O	1:B:315:LYS:HG3	2.20	0.41
1:B:116:TYR:CD2	1:B:144:SER:HB3	2.55	0.41
1:D:116:TYR:CD2	1:D:144:SER:HB3	2.55	0.41
1:D:378:SER:OG	1:D:380:VAL:HG22	2.21	0.41
1:A:85:ASN:HA	1:B:23:PHE:CD1	2.56	0.41
1:A:38:TRP:CE3	1:A:351:LEU:HD22	2.56	0.40
1:A:189:SER:HB3	1:A:217:HIS:NE2	2.36	0.40
1:A:202:ASP:OD1	1:A:238:ARG:NH2	2.55	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:38:TRP:CH2	1:D:40:ARG:HG2	2.56	0.40
1:D:94:ARG:NE	1:E:25:ASP:OD2	2.54	0.40
1:A:145:MET:HE1	1:A:185:GLU:HG3	2.04	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	396/401 (99%)	383 (97%)	10 (2%)	3 (1%)	16	37
1	B	394/401 (98%)	384 (98%)	9 (2%)	1 (0%)	36	60
1	D	396/401 (99%)	387 (98%)	7 (2%)	2 (0%)	24	48
1	E	396/401 (99%)	385 (97%)	10 (2%)	1 (0%)	36	60
All	All	1582/1604 (99%)	1539 (97%)	36 (2%)	7 (0%)	30	54

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	383	LEU
1	A	252	VAL
1	B	252	VAL
1	D	252	VAL
1	E	252	VAL
1	A	268	ARG
1	D	382	ASP

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar

resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	311/313 (99%)	296 (95%)	15 (5%)	23	50
1	B	310/313 (99%)	293 (94%)	17 (6%)	19	45
1	D	311/313 (99%)	298 (96%)	13 (4%)	26	55
1	E	311/313 (99%)	299 (96%)	12 (4%)	28	57
All	All	1243/1252 (99%)	1186 (95%)	57 (5%)	24	51

All (57) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	11	ILE
1	A	30	LYS
1	A	71	GLU
1	A	146	ILE
1	A	151	ARG
1	A	225	ARG
1	A	316	MET
1	A	325	ILE
1	A	326	ILE
1	A	351	LEU
1	A	361	ILE
1	A	383	LEU
1	A	385	GLN
1	A	396	LEU
1	B	12	GLN
1	B	40	ARG
1	B	71	GLU
1	B	158	ILE
1	B	168	ARG
1	B	189	SER
1	B	280	LEU
1	B	289	GLN
1	B	312	LYS
1	B	323	MET
1	B	325	ILE
1	B	326	ILE
1	B	343	THR

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	B	351	LEU
1	B	361	ILE
1	B	383	LEU
1	B	384	LYS
1	D	35	LYS
1	D	113	SER
1	D	156	LYS
1	D	164	VAL
1	D	169	GLU
1	D	189	SER
1	D	246	LEU
1	D	280	LEU
1	D	289	GLN
1	D	309	MET
1	D	326	ILE
1	D	351	LEU
1	D	383	LEU
1	E	94	ARG
1	E	151	ARG
1	E	164	VAL
1	E	189	SER
1	E	238	ARG
1	E	246	LEU
1	E	325	ILE
1	E	326	ILE
1	E	351	LEU
1	E	383	LEU
1	E	387	ASP
1	E	397	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	15	HIS
1	A	105	GLN
1	A	117	ASN
1	A	243	ASN
1	A	307	GLN
1	B	4	ASN
1	B	117	ASN
1	B	237	HIS
1	B	243	ASN

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Mol	Chain	Res	Type
1	B	307	GLN
1	B	359	GLN
1	D	12	GLN
1	D	37	GLN
1	D	39	ASN
1	D	54	ASN
1	D	105	GLN
1	D	243	ASN
1	D	342	HIS
1	E	85	ASN
1	E	142	HIS
1	E	243	ASN
1	E	307	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

### 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

7 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	PLG	E	500	-	20,20,20	1.46	2 (10%)	26,28,28	1.77	5 (19%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	PLG	D	500	-	20,20,20	1.72	3 (15%)	26,28,28	1.65	7 (26%)
3	ACY	D	600	-	3,3,3	0.95	0	3,3,3	0.59	0
3	ACY	E	600	-	3,3,3	0.74	0	3,3,3	1.08	0
2	PLG	B	500	-	20,20,20	1.96	6 (30%)	26,28,28	1.75	6 (23%)
2	PLG	A	500	-	20,20,20	1.84	6 (30%)	26,28,28	1.91	7 (26%)
3	ACY	A	600	-	3,3,3	0.64	0	3,3,3	1.00	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	PLG	E	500	-	-	7/12/12/12	0/1/1/1
2	PLG	B	500	-	-	7/12/12/12	0/1/1/1
2	PLG	A	500	-	-	7/12/12/12	0/1/1/1
2	PLG	D	500	-	-	6/12/12/12	0/1/1/1

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	500	PLG	P-OP1	3.90	1.62	1.50
2	D	500	PLG	C4A-C4	3.74	1.57	1.52
2	B	500	PLG	C4A-C4	3.67	1.57	1.52
2	D	500	PLG	P-OP1	3.65	1.61	1.50
2	B	500	PLG	C3-C2	3.63	1.44	1.41
2	A	500	PLG	C3-C2	3.49	1.44	1.41
2	B	500	PLG	P-OP1	3.41	1.61	1.50
2	A	500	PLG	P-OP1	3.11	1.60	1.50
2	B	500	PLG	C5-C4	3.03	1.44	1.40
2	D	500	PLG	C2A-C2	3.03	1.55	1.50
2	A	500	PLG	C2A-C2	2.98	1.55	1.50
2	B	500	PLG	C3-C4	2.76	1.44	1.40
2	A	500	PLG	C4A-C4	2.75	1.56	1.52
2	A	500	PLG	P-OP2	2.66	1.64	1.54
2	E	500	PLG	C4A-C4	2.53	1.55	1.52
2	A	500	PLG	OP4-C5A	-2.28	1.36	1.44
2	B	500	PLG	C6-C5	2.12	1.41	1.37

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	500	PLG	C4A-N-CA	-4.93	106.98	112.72
2	E	500	PLG	C4A-C4-C5	4.55	124.70	119.75
2	A	500	PLG	C6-C5-C4	4.28	121.30	118.06
2	B	500	PLG	C6-C5-C4	3.83	120.95	118.06
2	E	500	PLG	C6-C5-C4	3.77	120.91	118.06
2	B	500	PLG	C5A-C5-C6	-3.76	113.23	119.36
2	D	500	PLG	C6-C5-C4	3.68	120.84	118.06
2	E	500	PLG	O3-C3-C2	3.21	124.23	117.58
2	D	500	PLG	OP3-P-OP4	2.86	114.12	106.67
2	A	500	PLG	C2A-C2-C3	2.85	124.13	120.80
2	A	500	PLG	C5A-C5-C6	-2.78	114.83	119.36
2	B	500	PLG	C3-C4-C5	-2.66	116.32	118.73
2	B	500	PLG	OP3-P-OP4	2.62	113.51	106.67
2	A	500	PLG	C3-C4-C5	-2.56	116.41	118.73
2	D	500	PLG	C4A-C4-C5	2.52	122.50	119.75
2	B	500	PLG	C4A-N-CA	-2.49	109.82	112.72
2	D	500	PLG	OP2-P-OP1	-2.39	101.51	110.83
2	E	500	PLG	C5-C6-N1	-2.27	120.14	123.83
2	A	500	PLG	C4A-C4-C3	2.25	122.97	119.98
2	D	500	PLG	C3-C4-C5	-2.23	116.70	118.73
2	E	500	PLG	C5A-C5-C6	-2.14	115.88	119.36
2	B	500	PLG	C4A-C4-C5	2.10	122.03	119.75
2	D	500	PLG	C5A-C5-C6	-2.10	115.94	119.36
2	A	500	PLG	O3-C3-C2	2.07	121.88	117.58
2	D	500	PLG	O3-C3-C2	2.01	121.74	117.58

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	500	PLG	C5A-OP4-P-OP2
2	A	500	PLG	C5A-OP4-P-OP3
2	B	500	PLG	C5A-OP4-P-OP1
2	B	500	PLG	C5A-OP4-P-OP2
2	B	500	PLG	C5A-OP4-P-OP3
2	D	500	PLG	C5-C4-C4A-N
2	D	500	PLG	C5A-OP4-P-OP2
2	D	500	PLG	C5A-OP4-P-OP3
2	E	500	PLG	C5A-OP4-P-OP2
2	E	500	PLG	C5A-OP4-P-OP3
2	A	500	PLG	C5-C4-C4A-N
2	B	500	PLG	C5-C4-C4A-N
2	A	500	PLG	C4-C4A-N-CA

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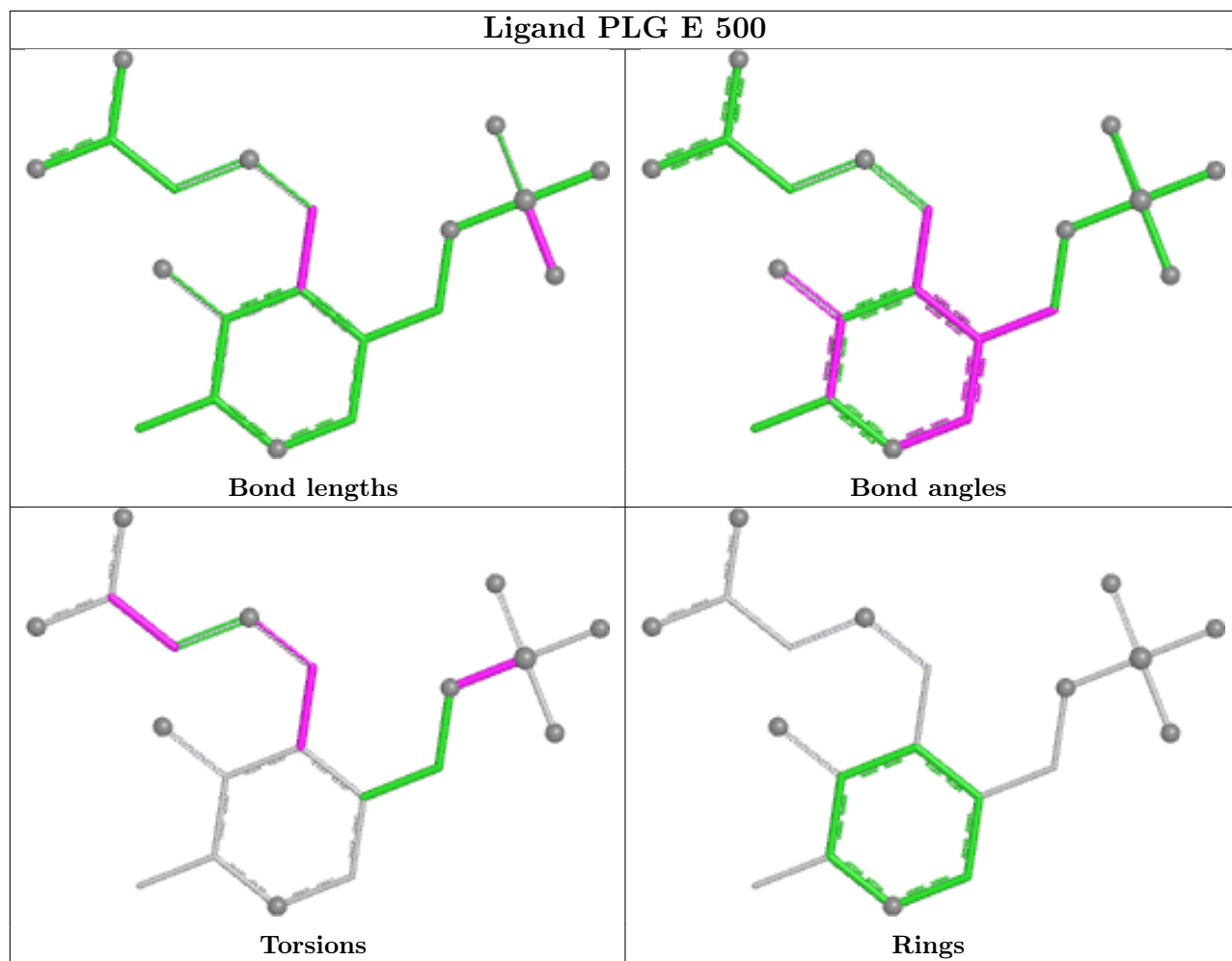
Mol	Chain	Res	Type	Atoms
2	B	500	PLG	OXT-C-CA-N
2	D	500	PLG	C3-C4-C4A-N
2	D	500	PLG	C4-C4A-N-CA
2	B	500	PLG	O-C-CA-N
2	E	500	PLG	C5-C4-C4A-N
2	A	500	PLG	C5A-OP4-P-OP1
2	A	500	PLG	C3-C4-C4A-N
2	B	500	PLG	C3-C4-C4A-N
2	E	500	PLG	C3-C4-C4A-N
2	E	500	PLG	O-C-CA-N
2	E	500	PLG	OXT-C-CA-N
2	A	500	PLG	C-CA-N-C4A
2	D	500	PLG	C5A-OP4-P-OP1
2	E	500	PLG	C4-C4A-N-CA

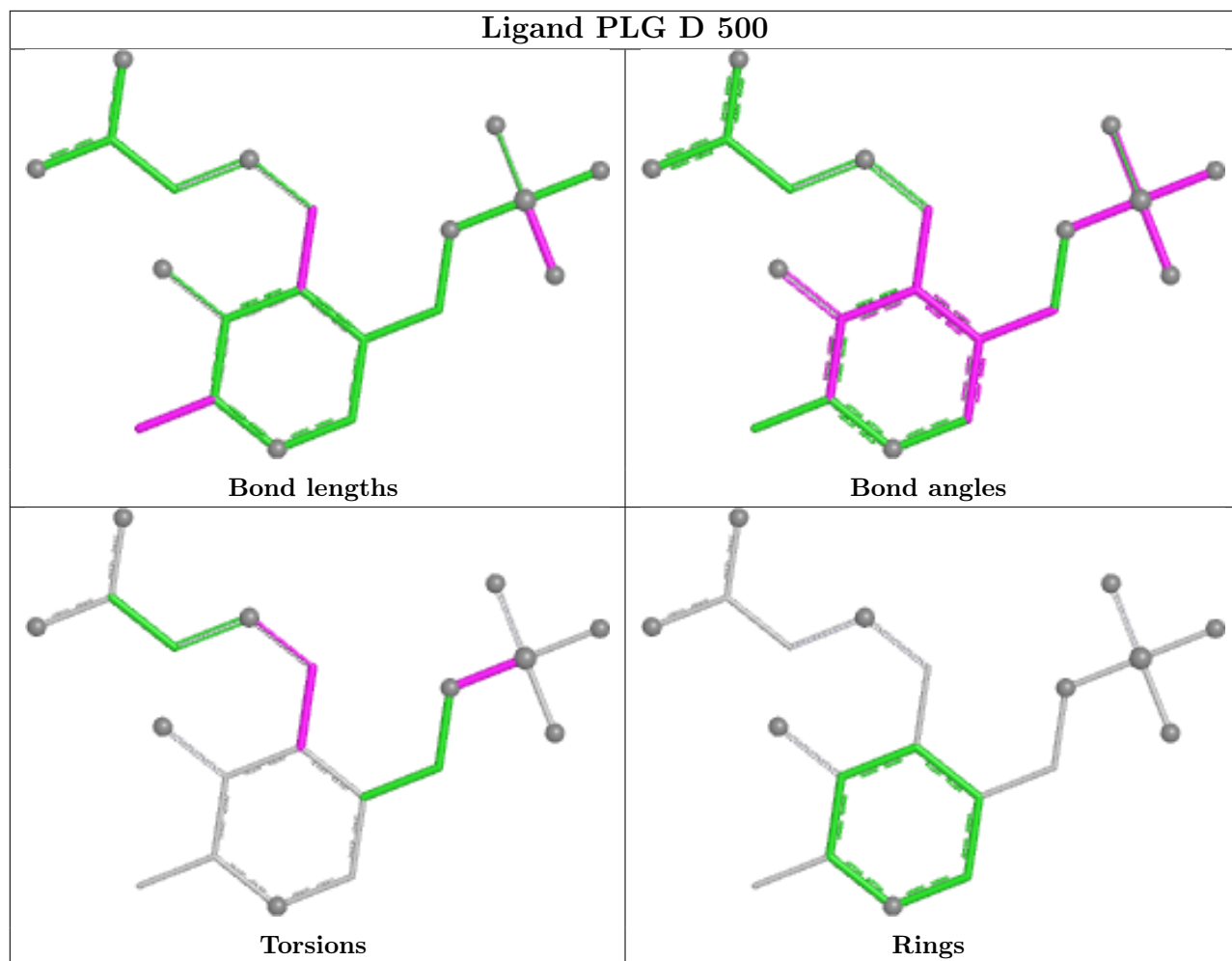
There are no ring outliers.

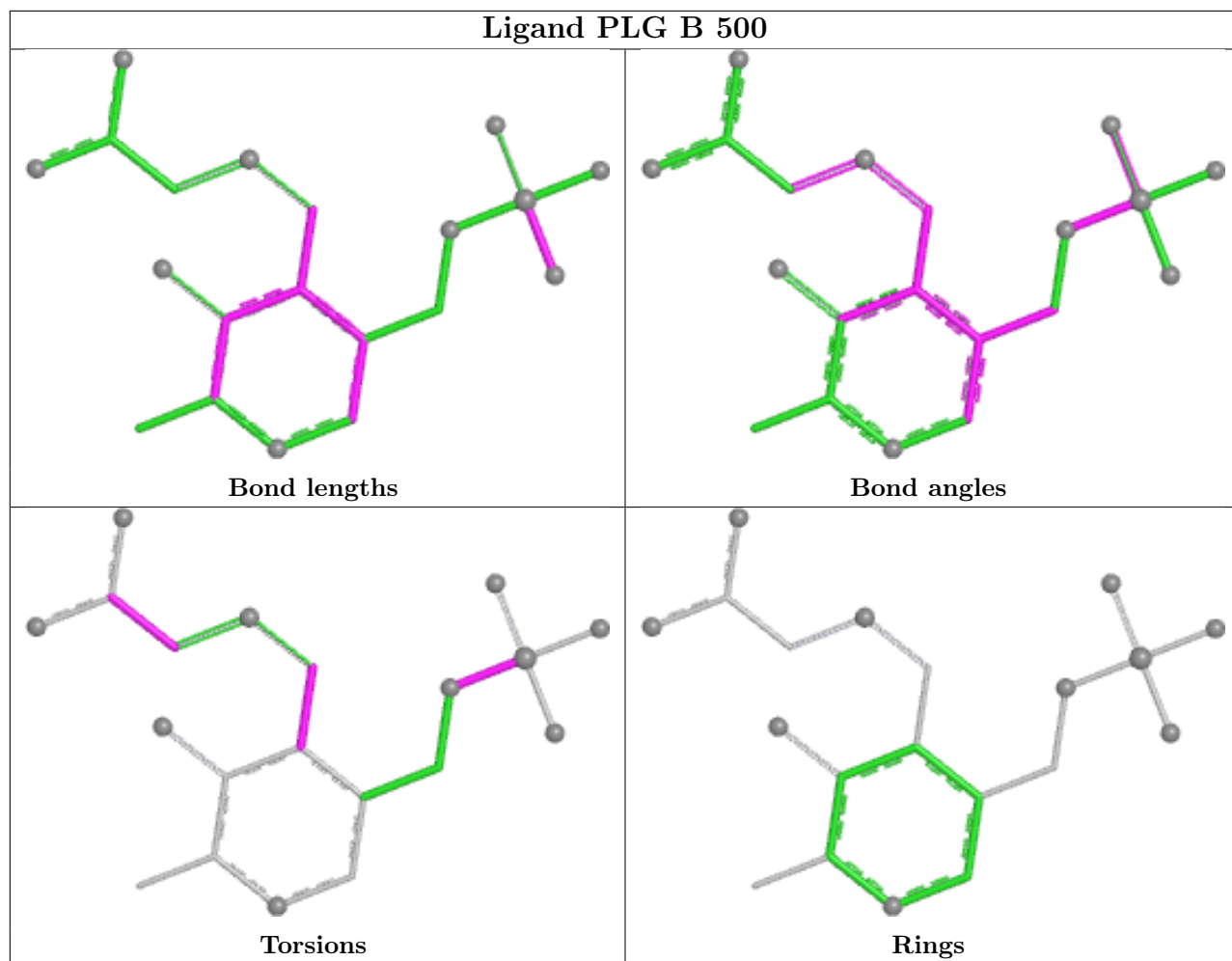
5 monomers are involved in 15 short contacts:

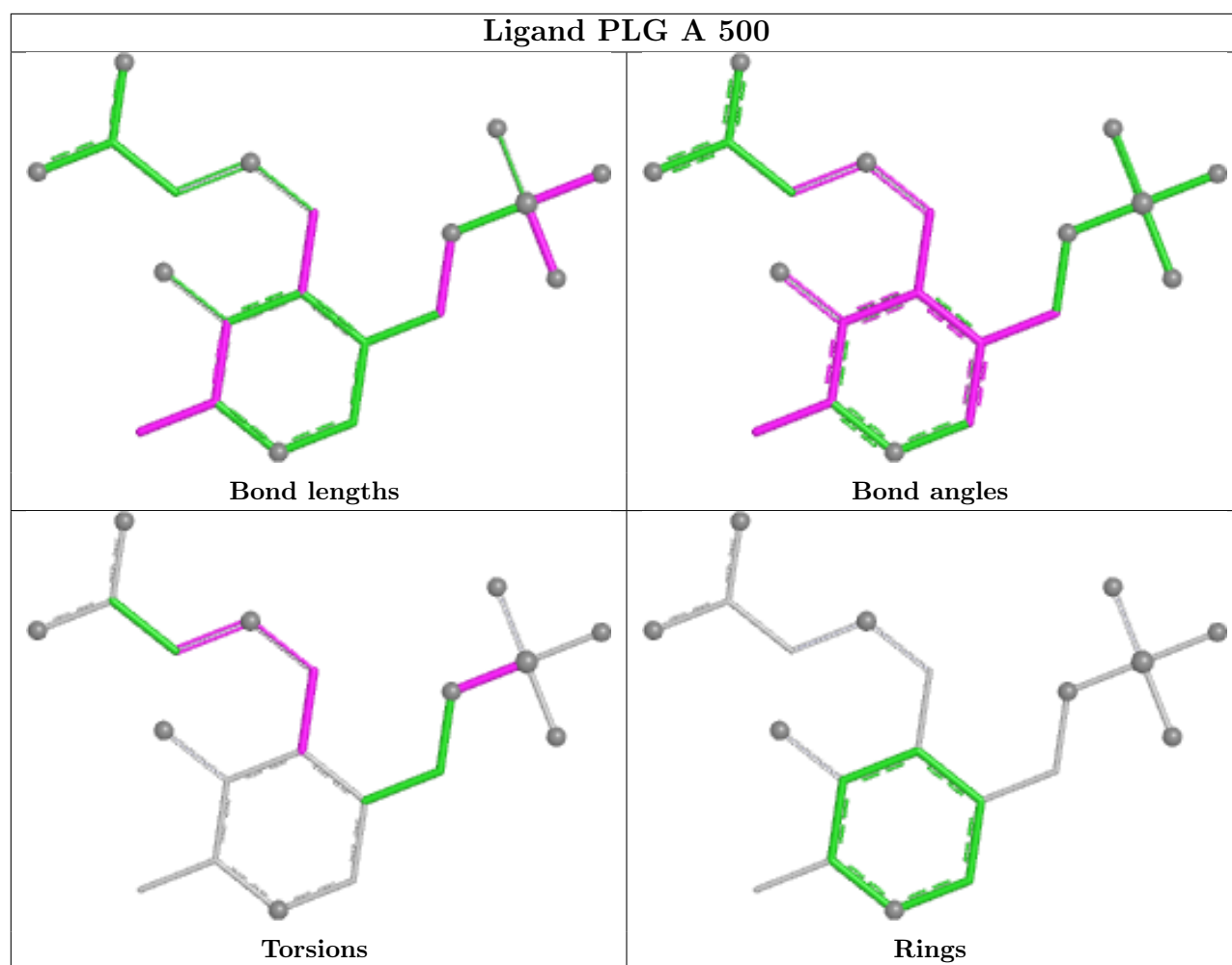
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	500	PLG	4	0
2	D	500	PLG	6	0
3	D	600	ACY	1	0
2	B	500	PLG	1	0
2	A	500	PLG	3	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	398/401 (99%)	-0.25	1 (0%) 90 89	18, 28, 45, 91	0
1	B	396/401 (98%)	-0.38	2 (0%) 87 86	18, 27, 45, 55	0
1	D	398/401 (99%)	-0.42	1 (0%) 90 89	18, 27, 45, 78	0
1	E	398/401 (99%)	-0.48	1 (0%) 90 89	18, 27, 45, 87	0
All	All	1590/1604 (99%)	-0.38	5 (0%) 90 89	18, 27, 45, 91	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	397	TRP	3.1
1	D	1	MET	2.8
1	A	398	ALA	2.6
1	B	326	ILE	2.3
1	B	396	LEU	2.2

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

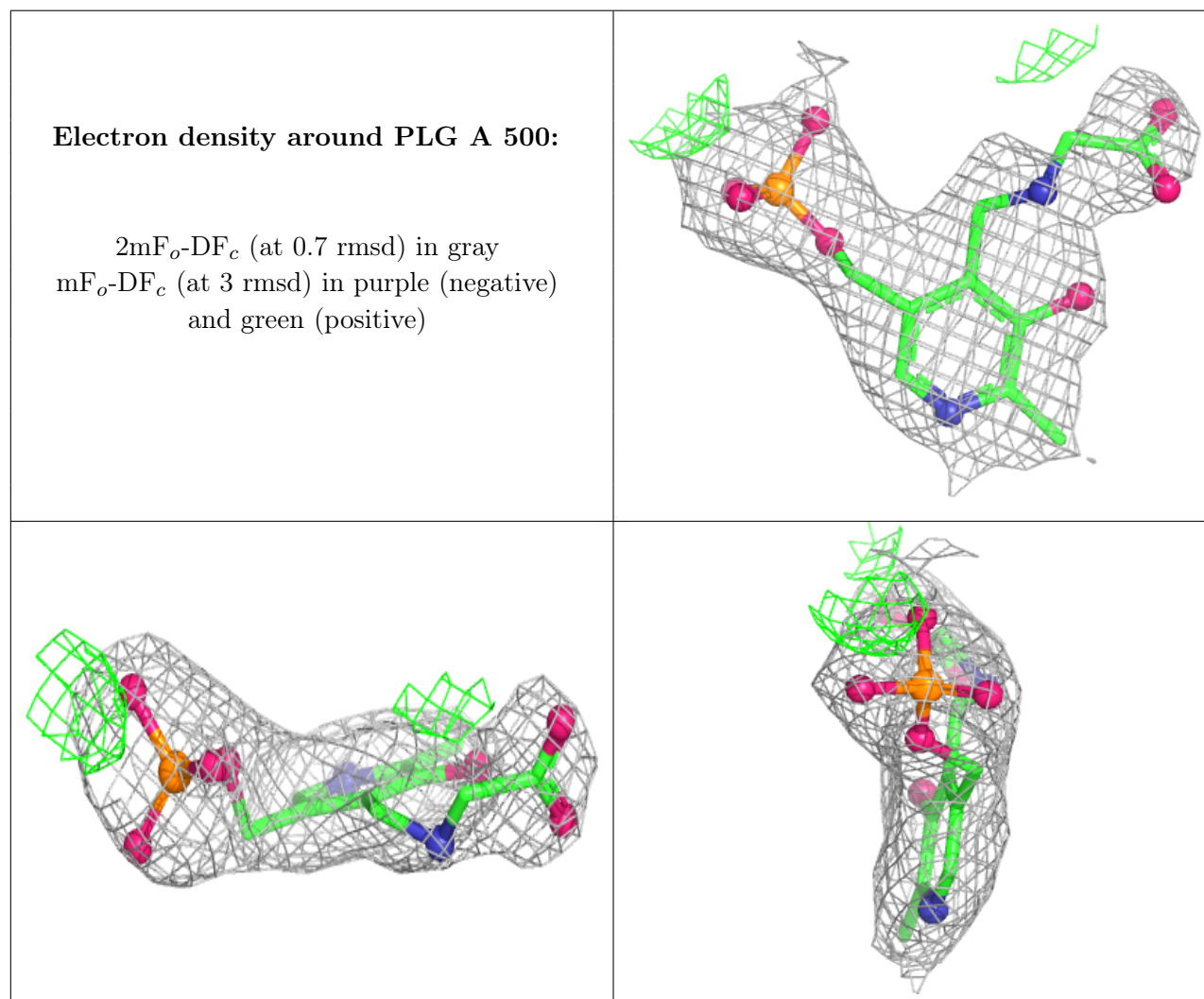
### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

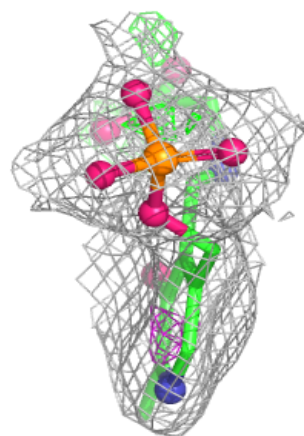
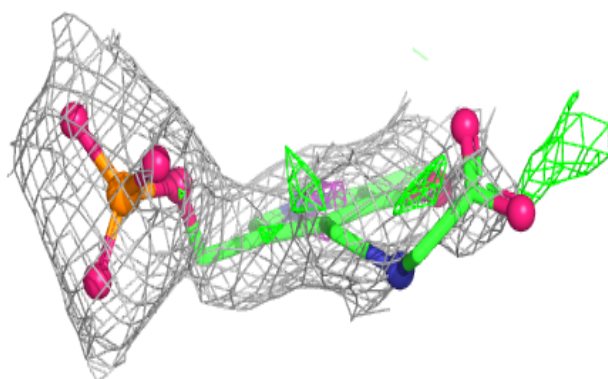
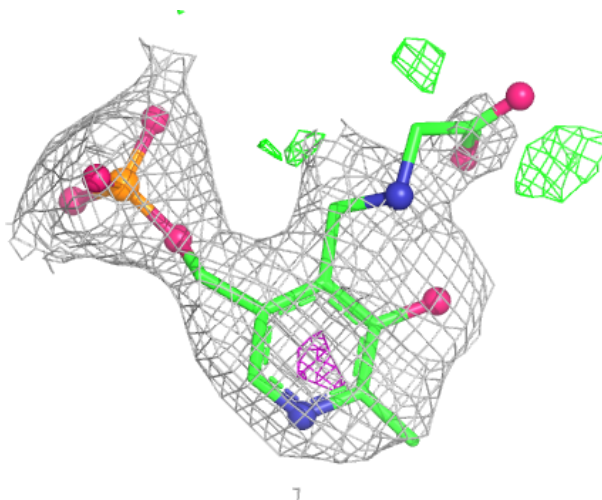
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	ACY	E	600	4/4	0.91	0.14	44,54,57,58	0
3	ACY	D	600	4/4	0.93	0.13	31,38,39,46	0
3	ACY	A	600	4/4	0.95	0.07	30,33,44,49	0
2	PLG	A	500	20/20	0.95	0.09	30,45,66,67	4
2	PLG	B	500	20/20	0.95	0.12	27,48,58,63	4
2	PLG	E	500	20/20	0.96	0.11	24,57,72,76	4
2	PLG	D	500	20/20	0.96	0.09	33,43,74,76	4

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



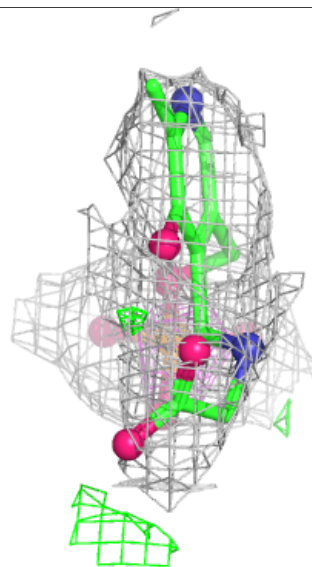
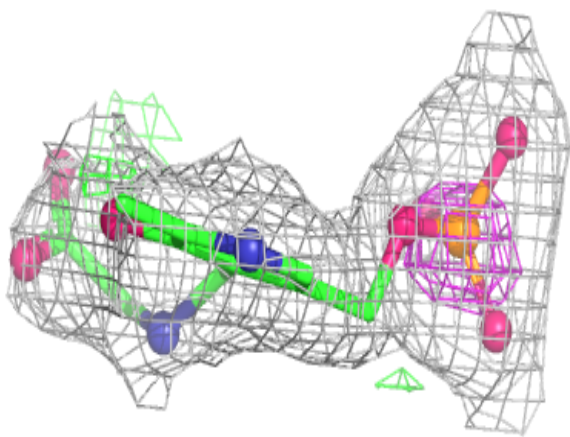
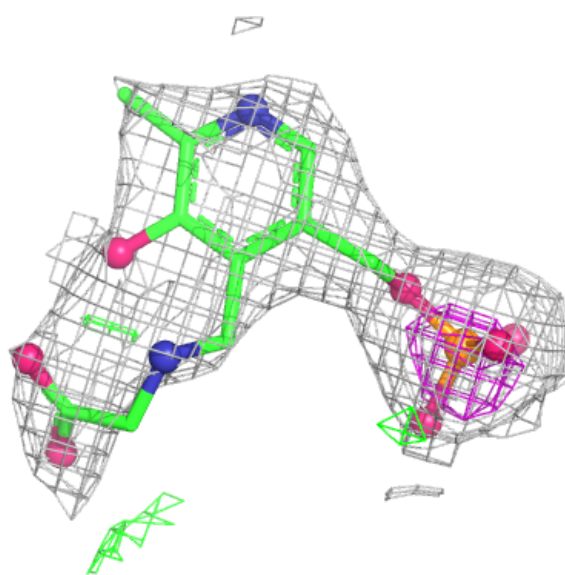
**Electron density around PLG B 500:**

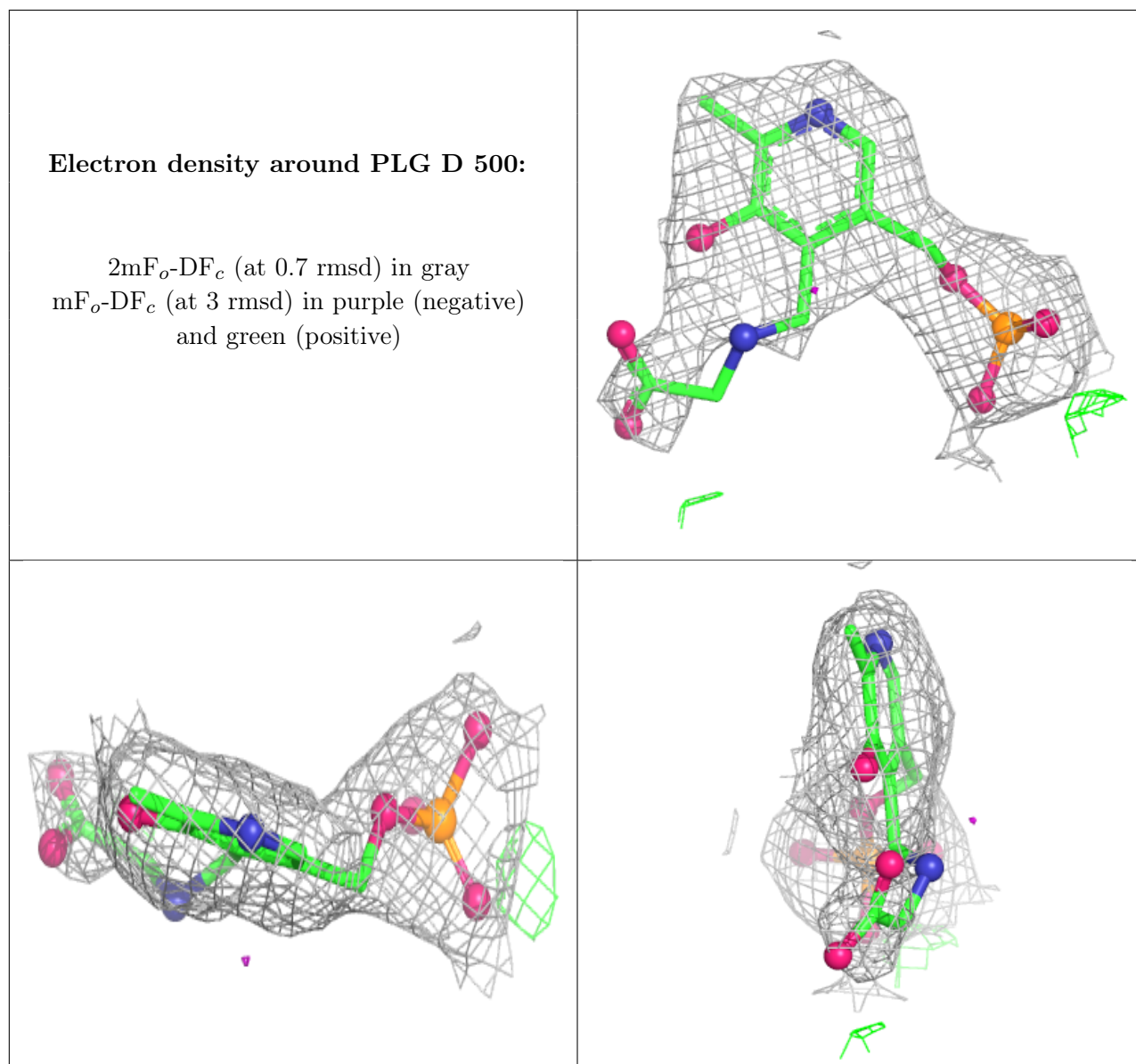
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around PLG E 500:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.